An Empirical Study Of Forex Risk Management Strategies

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INTRODUCTION

In the world of globalization and international business, firms would be performing one or the other kind of international activity like selling its products abroad, sourcing its raw materials from abroad, raising funds abroad or investing in international markets, and would have to deal with many currencies for making or receiving payments. This would expose them to foreign exchange risk, where an appreciation or depreciation of the currency it is dealing with may eat away its profits, making it necessary to manage foreign exchange risk.

Foreign exchange risk management has always been an attractive field for many researchers. Nevertheless, there is no uniformly accepted definition of foreign exchange risk management. Several authors (e.g. Baldoni, 1998; Rahardjo and Dowling, 1998; Ankrom, 1974) have provided definitions of foreign exchange risk management. Among the first authors to define foreign exchange risk was Ankrom (1974). He classified foreign exchange exposures into translation, transaction and economic exposures. Translation exposure is the accountant's record of profit and loss in translating balance sheet accounts into the home currency. Transaction exposure is the foreign exchange exposure associated with sales or transactions that have already been made, but for which payment is due at some future date. Lastly, economic exposure is the combination of translation and transaction exposures. Ankrom (1974) argued that economic exposure is a comprehensive measure for the firm's foreign exchange exposures. However, economic exposure is usually very complex as it involves not only known cash flows but also unknown future cash flows (Glaum, 1990; Belk and Glaum, 1990).

There have been several recent studies on foreign exchange risk management which have focused on managing foreign exchange risk while doing business in developing countries.

Murray (2005) studied two types of risk associated with foreign currency denominated assets and liabilities. Transaction risk is the risk one incurs whenever they physically convert from one currency to another. Translation risk is the risk one incurs when they hold assets or liabilities in a foreign currency. These two risks can be related if one takes the example of a sale of goods in a foreign currency. Holding the accounts receivable over the end of a closing period will result in translation risk and possibly an unrealized foreign exchange gain or loss.

Abor (2005) suggested that foreign exchange risk is mainly managed by adjusting prices to reflect changes in import prices resulting from currency fluctuation, and also by buying and saving foreign currency in advance. The main problems that firms face are the frequent appreciation of foreign currencies against the local currency and the difficulty in retaining local customers because of the high prices of imported inputs, which tend to affect the prices of their final products sold locally.

Jesswein et al (1995) studied the usage pattern of foreign exchange management strategies by American firms. They find that the popularity of the simpler, first-generation product (forward currency contracts) has not been overtaken by the sophisticated new entrants, and that the adoption of innovative foreign exchange risk management products is not as common as expected.

Yazid and Muda (2006) studied the usage pattern of foreign exchange management strategies in multinational corporations. They found that multinationals are involved in foreign exchange risk management primarily because they sought to minimise operational overall cash flows, which are affected by currency volatility. Also, the majority of multinationals centralise their risk management activities and at the same time impose greater control by frequent reporting on derivative activities. It is likely that huge financial losses related to derivative trading in the past led to top management being extra cautious.

Though many studies have revealed that active currency management by using derivatives is very much necessary for the firm to be on par with the competitors in a global business environment, there are some studies which argue otherwise. According to Copeland and Joshi (1996), foreign exchange risk management programs may cause more harm than good. Their study of nearly two hundred large companies has yielded enough evidence to cast serious doubt about the economic benefits of foreign exchange hedging programs. Given scarce management time and the substantial amount of capital currently devoted to hedging, it is clear that many programs diminish value instead of creating it. Hedging theories assume a static world in which all factors apart from foreign exchange rates stay exactly the same. In addition, the relationships between these factors are shifting constantly. Hard enough to understand in hindsight, they are virtually impossible to predict in advance. Although derivatives are generally ineffective in managing foreign exchange risk, senior managers

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should not simply throw up their hands and resign themselves to being pummeled by the markets. Even though the study was against using derivatives for foreign exchange risk management, it concludes by suggesting that "Hedging individual transactions may not work, but foreign exchange exposures at the company cash flow level can be managed" (Copeland and Joshi, 1996).

DATA & METHODOLOGY

The management of foreign exchange risk involves three questions. First, what exchange risk does the firm face, and what methods are available to measure foreign exchange exposure? Second, based on the nature of the exposure and the firm's ability to forecast currencies, what hedging or exchange risk management strategy should the firm employ? And finally, which of the various tools and techniques of the foreign exchange market should be employed: forwards/futures, options, or any other tool?

This study deals with the various strategies of managing transaction, translation and economic exposures from the viewpoint of the exporter (who would be receiving foreign currencies) and the importer (who would be paying foreign currencies). For the purpose of the study, one hundred streams of six-month USD cash inflows and outflows were randomly generated from a fixed probability distribution. The effects of using hedging strategies such as forward currency contracts, currency options, and cross-currency hedging on each of these cash flows were calculated and compared. The objective of the study was to identify strategies which not only hedged against foreign exchange risk, but also yielded good returns, and to suggest conditions under which these foreign exchange risk management strategies may be preferable over others.

The data for the study was collected through secondary sources like books, websites and magazines. The research period chosen was April 2004 to March 2008. The spot USD/INR rates and other relevant exchange rates (against USD) for the period 2004-2008 were the starting point of the calculations. Interest rate parity was calculated using the inter-bank offering rates of MIBOR and LIBOR as at the beginning of each six-month period in the research period. Purchasing power parity was calculated by using inflation rates in India and USA as at the beginning of each six-month period in the research period. Using these data, the returns under each risk management strategy for each sample cash flow were then calculated. Finally, the different risk management strategies were compared by performing paired-samples t-tests for equality of mean returns.

The following foreign exchange risk management strategies were considered:

Without Hedging: This represents the base series of cash flows in INR, when the transaction is not hedged. This is the most risky way of handling international financial exposure. According to this strategy, transactions will take place at the corresponding spot exchange rate. The corresponding spot USD/INR exchange rates in the research period are presented in Table 1.

TABLE 1

Date	USD-INR spot rate	Date	USD-INR spot rate
4/30/2004	44.4250	4/30/2006	45.0007
5/31/2004	45.4500	5/31/2006	46.2273
6/30/2004	46.0800	6/30/2006	46.4176
7/31/2004	46.4500	7/31/2006	46.6150
8/31/2004	46.3800	8/31/2006	46.5193
9/30/2004	46.0300	9/30/2006	45.9884
10/31/2004	45.4700	10/31/2006	45.0808
11/30/2004	44.7300	11/30/2006	44.6941
12/31/2004	43.7300	12/31/2006	44.1200
1/31/2005	43.7300	1/31/2007	44.1800
2/28/2005	43.7500	2/28/2007	44.2131
3/31/2005	43.7900	3/31/2007	43.4417
4/30/2005	43.5900	4/30/2007	41.1050
5/31/2005	43.6550	5/31/2007	40.8700
6/30/2005	43.6100	6/30/2007	40.7350
7/31/2005	43.5150	7/31/2007	40.5500
8/31/2005	44.0900	8/31/2007	41.1700
9/30/2005	44.0500	9/30/2007	39.8100
10/31/2005	45.1200	10/31/2007	39.4600
11/30/2005	45.9479	11/30/2007	39.7650
12/31/2005	45.1950	12/31/2007	39.4350
1/31/2006	44.1588	1/31/2008	39.3900
2/28/2006	44.5128	2/29/2008	39.8561
3/31/2006	44.6176	3/31/2008	39.9451

[1]www.rbi.org.in

Hedging with forward currency contacts: According to this strategy, the trader will enter into forward currency contracts at the beginning of the planning period to hedge the expected cash flows. The forward rates were calculated giving equal weight to Interest Rate Parity and Purchasing Power Parity. The interest rates and inflation rates used for the calculations are shown in Table 2.

TABLE 2

	For IRP	
	one-month MIBOR	**one-month LIBOR**
as on 1st Apr-04	4.50%	1.81%
as on 1st Oct - 04	4.61%	2.53%
as on 1st Apr - 05	4.81%	3.71%
as on 1st Oct-05	5.18%	4.68%
as on 1st Apr-06	6.43%	5.42%
as on 1st oct-06	6.62%	5.33%
as on 1st Apr-07	14.42%	5.30%
as on 1st oct-07	6.12%	4.90%
For PPP		
	Indian inflation	**US inflation**
as on 1st Apr-04	4.51%	2.29%
as on 1st Oct - 04	7.27%	3.19%
as on 1st Apr - 05	5.91%	3.51%
as on 1st Oct-05	4.71%	4.35%
as on 1st Apr-06	3.86%	3.55%
as on 1st oct-06	5.51%	1.31%
as on 1st Apr-07	4.92%	2.57%
as on 1st oct-07	0.05%	3.54%

Hedging with currency options: According to this strategy, the trader will enter into a currency options contract at the beginning of the planning period to hedge the expected cash flows. A series of outflows of foreign currencies can be hedged by buying currency call options, while a series of inflows of foreign currencies can be hedged by buying currency put options. The Black-Scholes model was used to calculate the call/put price using the following formulae:

$C = -Xe^{-r(T-t)}N(d_2) + Se^{-r_f(T-t)}N(d_1)$ and $P = Xe^{-r(T-t)}N(-d_2) - Se^{-r_f(T-t)}N(-d_1)$,

where *S* represents the spot price, *X* represents the strike price, $T-t$ represents the time remaining until expiration (expressed as a percent of one year), *r* represents the continuously compounded risk-free rate of interest for the domestic currency, *rf* represents the continuously compounded risk-free rate of interest for the foreign currency, α represents the annual volatility of spot price (defined as the standard deviation of the short-term returns over one year), *N(.)* represents the standard normal cumulative distribution function, and d_1 and d_2 are given by the formulae:

$$d_1 = \frac{\ln\left(\frac{S}{X}\right) + \left(r - r_f + \frac{1}{2}\sigma^2\right).(T-t)}{\sigma.\sqrt{(T-t)}} \text{ and } d_2 = d_1 - \sigma.\sqrt{(T-t)}\,.$$

The strike prices used in the study were set at the exchange rate at the beginning of the planning period.

Cross-currency hedging: According to this strategy, the trader will enter into a contract at the beginning of the planning period specifying that the transactions are to be in a third currency, correlated to the foreign currency. In the selected research period, it was found that the Singapore Dollar (SGD) was the most positively correlated currency for USD.

The realized net cash flows in INR were calculated for each of the sample cash flows, under each of the above risk management strategies. For inflows, a profit resulted if the actual receipts were more than expected, while a loss resulted if the actual receipts are less than expected, whereas for outflows, a profit resulted if the actual payments made were less than expected, while a loss resulted if the actual payments made were more than expected. This was applied for each of the one hundred random series of sample cash flows under each strategy, and the mean returns and standard deviation of returns were found out for each strategy.

DATA ANALYSIS & INTERPRETATION

The means and standard deviations of the returns for the series of cash flows under different strategies in the period Apr-04 to Sep-04 are summarized in Table 3. For the series of inflows, it was found that the unhedged strategy yielded the highest mean returns, and the forwards strategy yielded the lowest mean returns. For the series of outflows, it was found that the options strategy yielded the highest mean returns, and the unhedged strategy yielded the lowest mean returns. The paired-samples t-tests indicated that the differences in mean returns between all pairs of different strategies were statistically significant. The movement in the USD/INR exchange rate in this period, as shown in Chart 1, indicates an increasing trend.

TABLE 3

	USD outflows Apr-04 to Sep-04		USD inflows Apr-04 to Sep-04	
STRATEGY	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Unhedged	-768082.50	182093.66	768082.50	182093.66
Forward	-2332.37	560.33	2332.37	560.33
Option	205474.46	48002.55	683734.46	162882.94
Cross-currency	-471179.94	114437.91	471179.94	114437.91

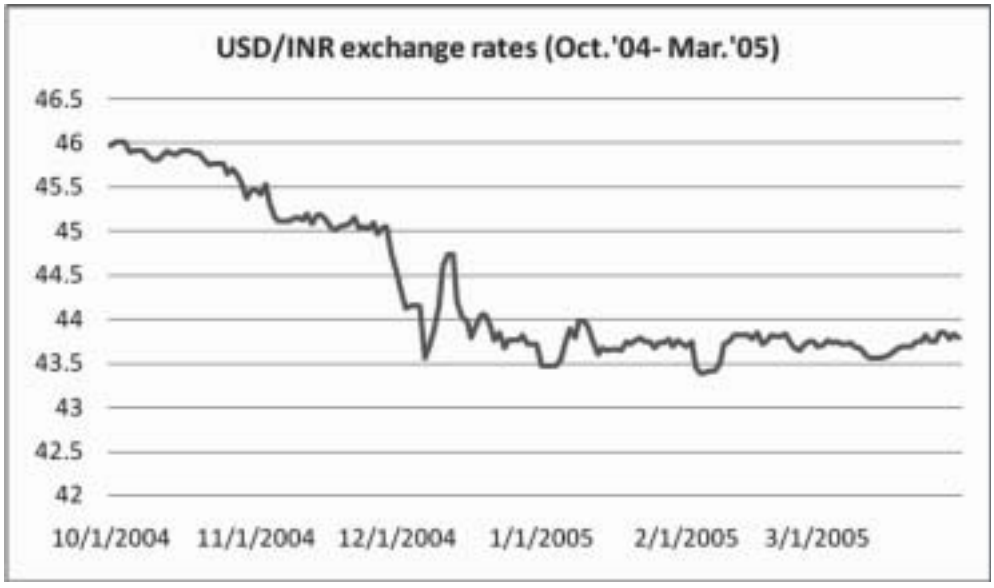
CHART 1

The means and standard deviations of the returns for the series of cash flows under different strategies in the period Oct-04 to Mar-05 are summarized in Table 4. For the series of inflows, it was found that the forwards strategy yielded the highest mean returns, and the unhedged strategy yielded the lowest mean returns. For the series of outflows, it was found that the options strategy yielded the highest mean returns, and the forwards strategy yielded the lowest mean returns. The paired-samples t-tests indicated that the differences in mean returns between all pairs of different strategies were statistically significant. The movement in the USD/INR exchange rate in this period, as shown in Chart 2, indicates a decreasing trend.

TABLE 4

	USD outflows Oct-04 to March-05		USD inflows Oct-04 to March-05	
STRATEGY	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Unhedged	584138.50	140510.64	-584138.50	140510.64
Forward	-2927.29	703.25	2927.29	703.25
Option	801381.36	190550.06	-89179.00	20560.35
Cross-currency	215332.31	57986.71	-215332.31	57986.71

CHART 2



The means and standard deviations of the returns for the series of cash flows under different strategies in the period Apr-05 to Sep-05 are summarized in Table 5. For the series of inflows, it was found that the forwards strategy yielded the highest mean returns, and the cross-currency strategy yielded the lowest mean returns. For the series of outflows, it was found that the options strategy yielded the highest mean returns, and the forwards strategy yielded the lowest mean returns. The paired-samples t-tests indicated that the differences in mean returns between all pairs of different strategies were statistically significant. The movement in the USD/INR exchange rate in this period, as shown in Chart 3, indicates a great deal of fluctuation in the exchange rate.

TABLE 5

	USD outflows Apr-05 to Sep-05		USD inflows Apr-05 to Sep-05	
STRATEGY	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Unhedged	21561.10	15365.05	-21561.10	15365.05
Forward	-1665.57	400.14	1665.57	400.14
Option	244578.86	57129.49	-68684.65	17762.80
Cross-currency	185951.35	49784.92	-185951.35	49784.92

CHART 3

The means and standard deviations of the returns for the series of cash flows under different strategies in the period Oct-05 to Mar-06 are summarized in Table 6. For the series of inflows, it was found that the cross-currency strategy yielded the highest mean returns, and the forwards strategy yielded the lowest mean returns. For the series of outflows, it was found that the options strategy yielded the highest mean returns, and the cross-currency strategy yielded the lowest mean returns. The paired-samples t-tests indicated that the differences in mean returns between all pairs of different strategies were statistically significant. The movement in the USD/INR exchange rate in this period, as shown in Chart 4, indicates a cyclic fluctuation in the exchange rate.

TABLE 6

	USD outflows Oct-05 to March-06		USD inflows Oct-05 to March-06	
STRATEGY	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Unhedged	-288218.70	76688.36	288218.70	76688.36
Forward	-411.07	98.75	411.07	98.75
Option	208144.79	48626.40	202774.48	60688.07
Cross-currency	-630906.25	145874.67	630906.25	145874.67

CHART 4

The means and standard deviations of the returns for the series of cash flows under different strategies in the period Apr-06 to Sep-06 are summarized in Table 7. For the series of inflows, it was found that the cross-currency strategy yielded in the highest mean returns, and the forwards strategy yielded the lowest mean returns. For the series of outflows, it was found that the options strategy yielded the highest mean returns, and the cross-currency strategy yielded the lowest mean returns. The paired-samples t-tests indicated that the differences in mean returns between all pairs of different strategies were statistically significant. The movement in the USD/INR exchange rate in this period, as shown in Chart 5, indicates an increasing trend.

TABLE 7

	USD outflows Apr-06 to Sep-06		USD inflows Apr-06 to Sep-06	
STRATEGY	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Unhedged	-493312.60	120730.58	493312.60	120730.58
Forward	-808.13	194.14	808.13	194.14
Option	211052.39	49305.66	406674.80	101488.33
Cross-currency	-821390.33	194400.40	821390.33	194400.40

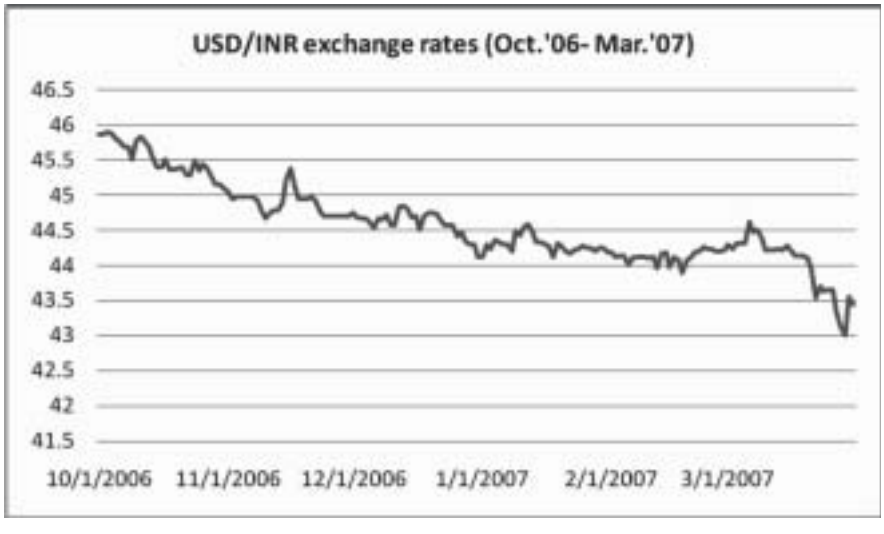
CHART 5

The means and standard deviations of the returns for the series of cash flows under different strategies in the period Oct-06 to Mar-07 are summarized in Table 8. For the series of inflows, it was found that the forwards strategy yielded the highest mean returns, and the unhedged strategy yielded the lowest mean returns. For the series of outflows, it was found that the options strategy yielded the highest mean returns, and the forwards strategy yielded the lowest mean returns. The paired-samples t-tests indicated that the differences in mean returns between all pairs of different strategies were statistically significant. The movement in the USD/INR exchange rate in this period, as shown in Chart 6, indicates a decreasing trend.

TABLE 8

	USD outflows Oct-06 to March-07		USD inflows Oct-06 to March-07	
STRATEGY	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Unhedged	499701.87	117712.89	-499701.87	117712.89
Forward	-2868.41	689.11	2868.41	689.11
Option	716472.10	168223.68	-88984.98	20515.62
Cross-currency	19076.83	10481.49	-19076.83	10481.49

CHART 6



The means and standard deviations of the returns for the series of cash flows under different strategies in the period Apr-07 to Sep-07 are summarized in Table 9. For the series of inflows, it was found that the forwards strategy yielded in the highest mean returns, and the cross-currency strategy yielded the lowest mean returns. For the series of outflows, it was found that the options strategy yielded the highest mean returns, and the forwards strategy yielded the lowest mean returns. The paired-samples t-tests indicated that the differences in mean returns between all pairs of different strategies were statistically significant. The movement in the USD/INR exchange rate in this period, as shown in Chart 7, indicates a decreasing trend.

TABLE 9

	USD outflows Apr-07 to Sep-07		USD inflows Apr-07 to Sep-07	
STRATEGY	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Unhedged	892379.56	209842.47	-892379.56	209842.47
Forward	-5454.68	1310.43	5454.68	1310.43
Option	1097696.60	256945.00	-84283.42	19431.66
Cross-currency	915934.92	214810.16	-915934.92	214810.16

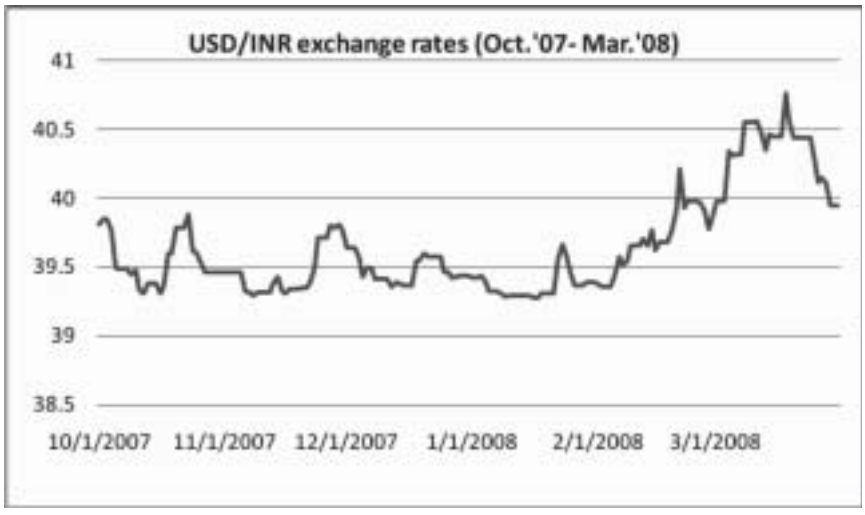
Chart 7

The means and standard deviations of the returns for the series of cash flows under different strategies in the period Oct-07 to Mar-08 are summarized in Table 10. For the series of inflows, it was found that the cross-currency strategy yielded the highest mean returns, and the options strategy yielded the lowest mean returns. For the series of outflows, it was found that the options strategy yielded the highest mean returns, and the cross-currency strategy yielded the lowest mean returns. The paired-samples t-tests indicated that the differences in mean returns between all pairs of different strategies were statistically significant. The movement in the USD/INR exchange rate in this period, as shown in Chart 8, indicates a cyclic fluctuation in the exchange rate.

TABLE 10

	USD outflows Oct-07 to March-08		USD inflows Oct-07 to March-08	
STRATEGY	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Unhedged	58866.21	23562.97	-58866.21	23562.97
Forward	1080.36	259.54	-1080.36	259.54
Option	254246.74	60573.52	-70009.52	16527.94
Cross-currency	-501263.82	125950.08	501263.82	125950.08

Chart 8



DISCUSSION

It is always risky to remain unhedged against foreign exchange rate fluctuations. There are several foreign exchange risk management strategies available, but it is very important to select that which best suits one's risk profile. This in turn depends on the how the situation is analyzed.

The results of the study indicate that, for currency outflows, hedging with currency options contracts was found to result in the highest mean returns, irrespective of the movement of the exchange rate. While using currency options, one should be careful in selecting the right strike price. On the other hand, for currency inflows, hedging with forward currency contracts was found to result in the highest mean returns whenever there was a decreasing trend in the exchange rate; cross-currency hedging was found to result in the highest mean returns whenever there was a cyclic fluctuation in the exchange rate; however, when there was an increasing trend in the exchange rate, there was no single hedging strategy yielding the highest mean returns. It would be an added advantage for one to use a combination of strategies to manage foreign exchange exposure.

A major limitation of the study was in considering only a few foreign exchange risk management strategies, under a stringent set of assumptions. For example, the strike price used in the study for the options strategy was set at the exchange rate at the beginning of the planning period, but in practice, a range of strike prices is usually available. Also, the Singapore Dollar (SGD) was used in the study for the cross-currency strategy, as it was highly correlated with the USD, but other currencies, especially the EURO, could have been investigated in its stead; also, the currencies that are negatively correlated with the USD and currencies with low coefficient of variation would be expected to perform well in the cross-currency strategy. Further, the cross-currency strategy could be used with a portfolio of currencies, not just with single currency. There is a vast scope for further research in this area. Furthermore, several other foreign exchange risk management strategies, including currency swaps, risk-sharing, and risk-shifting could also be used to hedge foreign exchange risk. Another limitation is that the study did not address a fundamental study of currencies, which would have helped in better implementation of the strategies. In particular, there is scope for further research into the relationship between optimal foreign exchange risk management strategies and the fundamentals of different currencies. Finally, the study has used historical data to compare the strategies, so that the inferences that have been drawn can only hold for a similar trend in exchange rates.

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